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The Delphion Integrated View

Title: **JP10189774A2: SEMICONDUCTOR MEMORY ELEMENT, FABRICATION THERE SEMICONDUCTOR MEMORY**

Country: JP Japan
Kind: A

Inventor: **TERAMOTO SHIGEKI;**

Assignee: **SONY CORP**
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Application Number: **JP1996000343790**

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Priority Number: 1996-12-24 **JP1996000343790**

Abstract:

PROBLEM TO BE SOLVED: To reduce the size while preventing fluctuation of redundancy information due to UV-ray erasure by preventing an UV-ray from impinging on a floating gate thereby simplifying the troublesome redundant switching work.

SOLUTION: An inter-gate insulation layer 4 is formed on a semiconductor substrate 1 while covering a floating gate 3 formed through a tunnel gate insulator 2 and a control gate 5 comprising a laminate of silicide WSi and polysilicon is formed thereon thus constituting a memory cell. The control gate 5 is then sandwiched by source and drain regions 6S, 6D and the floating gate 3 is formed while straddling a part of the tunnel gate insulator 2 and an isolation layer 7 thus isolating the active region 8 of the memory cell. Since UV-ray is shielded efficiently by covering the upper and side faces of the floating gate with a control gate made of an UV-ray blocking material, information can be prevented from fluctuating.

Family: None

Other Abstract Info: DERABS G98-452113 DERG98-452113

JP 10-189774 - to Teramoto Published July 21, 1998 – Sony Corp.

CLAIMS

[Claim 1] The semiconductor storage element characterized by having a source field, a drain field, the floating gate, and the control gate, being covered at the above-mentioned control gate where the above-mentioned floating gate consists of material which does not penetrate ultraviolet rays, and changing.

[Claim 2] The manufacture method of the semiconductor storage element characterized by to have the process which forms the process which forms the 1st electrode layer through a gate insulator layer on a semiconductor substrate, carries out pattern processing of this 1st electrode layer, and forms the floating gate, and the 2nd electrode layer which consist of material which does not penetrate ultraviolet rays through the insulating layer between the gates so that the above-mentioned floating gate may be covered, carries out pattern processing of this 2nd electrode layer, and forms the wrap control gate for the above-mentioned floating gate.

[Claim 3] The semiconductor memory characterized by using the semiconductor storage element of a publication for the above-mentioned claim 1 as a switch of redundant selection.

DETAILED DESCRIPTION

[0001] [The technical field to which invention belongs] this invention is applied to the nonvolatile semiconductor storage element as for example, a redundancy change element, and relates to a suitable semiconductor storage element, its manufacture method, and a semiconductor memory.

[0002] [Description of the Prior Art] Conventionally, the change in a poor bit and a spare bit has been performed by using the so-called laser fusing fuse which the redundant circuit of a nonvolatile semiconductor memory forms the fuse formed with polycrystal silicon etc., and melts the fuse corresponding to the poor bit which performs redundancy by laser.

[0003] In this case, the sequence for performing a change in a redundant circuit is as follows:

(1) A chip operation check on the ultraviolet-rays elimination (2) wafer level in wafer level (function test)

(3) The assembly (7) chip operation check of the ultraviolet-rays elimination (6) chip in the fusing (5) wafer level of the fuse which is a redundant selecting switch by the check (4) laser of redundant propriety judgment and a redundancy possible chip (function test)

[0004] In such a sequence, in order to have to perform each step of (2), (3), and (4) in equipment respectively different with a natural thing, for example, a circuit tester, and a laser cutter, it became very complicated [the work].

[0005] As a method for avoiding such complicatedness, there is a method of using a nonvolatile semiconductor storage element as a redundant change element instead of an above-mentioned laser fusing fuse. In this case, what is necessary is to fully draw out and depletion-ize an electron from a nonvolatile semiconductor storage element first, to make it an element be in switch-on, and just to intercept a flow by pouring in an electron, when redundancy is possible, in case the check of a chip of operation is performed.

[0006] Thus, since redundancy can be performed by changing the information on a nonvolatile semiconductor storage element on that spot at the time of a chip operation check on the wafer level which used the circuit tester of (2) when a nonvolatile semiconductor storage element is used as a redundant change element, (3) or (4) process mentioned above can be abolished. Furthermore, it is what became poor after the assembly of a chip, and since a redundant change can be electrically performed also to the chip in which relief by the redundant circuit is possible, the relief efficiency by the redundant circuit can be raised.

[0007] [Problem(s) to be Solved by the Invention] However, since it changes simultaneous [the information on the nonvolatile semiconductor storage element used as a redundancy change element at the time of the ultraviolet-rays elimination process before subsequent assembly (5)] only when the information on a nonvolatile semiconductor storage element is changed into (2) on that spot at the time of a chip operation check on the wafer level using the circuit tester, using a nonvolatile semiconductor storage element as a redundancy change element, it is unutilizable as a redundancy change element.

[0008] In order to avoid this problem, as shown in drawing 5 , in the film which does not penetrate ultraviolet rays, such as aluminum wiring, for the nonvolatile semiconductor storage element for a redundancy change, and this example, the technology of preventing change of the information on the storage element by UV irradiation by covering by the wiring layer 59 is proposed.

[0009] The floating gate 53 is formed through the tunnel-gate insulator layer 52 on the front face of the semiconductor substrate 51, the control gate 55 is formed through the insulating layer 54 between the gates on the floating gate 53, and the semiconductor storage element 50 of drawing 5 constitutes stack gate structure. And the floating gate 53 and the control gate 55 of a stack structure are covered, the insulating layer 58 between the gates is formed thickly, and the wiring layer 59 which is wearing a front face further and serves as a shading film is formed. The diffusion layer 56 of the impurity used as the source section and the drain section is formed in semiconductor substrate 51 front face.

[0010] However, according to this technology, in order to prevent this in order that ultraviolet rays UV may enter from the crevice a between the insulating layers 58 between the gates between a wiring layer 59 and a substrate 51 as shown in drawing 5 , the cover of the wiring layer 59 used as a shading film needed to be taken widely enough, and there was a demerit that element area will become large as a result.

[0011] The semiconductor memory using the nonvolatile semiconductor storage element which simplified complicated redundancy change work when ultraviolet rays were made not to carry out incidence to the floating gate, prevented change of the redundant information by ultraviolet-rays elimination, and realized the miniaturization in this invention for solution of the problem mentioned above, using a semiconductor storage element as a redundancy change element, its manufacture method, and this semiconductor storage element is offered.

[0012] [Means for Solving the Problem] The semiconductor storage element of this invention is the composition that the control gate which consists of material which covers the floating gate and does not penetrate ultraviolet rays was formed.

[0013] Since the floating gate is covered at the control gate which consists of material which does not penetrate ultraviolet rays according to the semiconductor storage element of an above-mentioned this invention, the incidence of ultraviolet rays can be prevented and change of the information on the storage element by ultraviolet rays can be prevented. Moreover, since it shades by the control gate which covered the floating gate, without newly preparing a shading film and ends even if it does not form a shading film widely while being able to prevent the incidence of the ultraviolet rays from the side of the floating gate, the miniaturization of a semiconductor storage element can be attained.

[0014] The manufacture method of the semiconductor storage element of this invention forms the 1st electrode layer through a gate insulator layer on a semiconductor substrate, it forms the floating gate, it carries out pattern processing of this 1st electrode layer, it forms the 2nd electrode layer which consists of material which does not penetrate ultraviolet rays through the insulating layer between the gates so that the floating gate may next be covered, carries out pattern processing of the 2nd electrode layer, and forms the wrap control gate for the floating gate.

[0015] According to the manufacture method of the semiconductor storage element of an above-mentioned this invention, the control gate which consists of material which does not penetrate ultraviolet rays can manufacture the semiconductor storage element which can shade ultraviolet rays by covering the floating gate through the insulating layer between the gates, and being formed. Moreover, in order to form the control gate and to consider as a shading film, manufacture is possible with the manufacturing process of the usual semiconductor storage element, and even if it does not make a manufacturing process increase, the semiconductor storage element which can shade ultraviolet rays can be manufactured.

[0016] The semiconductor memory of this invention is the composition using the above-mentioned semiconductor storage element, i.e., the semiconductor storage element covered at the control gate which consists of material into which this floating gate does not penetrate ultraviolet rays, as a switch of redundant selection.

[0017] According to the semiconductor memory of an above-mentioned this invention, even if it performs ultraviolet-rays elimination to storage elements other than this switch by using the semiconductor storage element which can carry out ultraviolet-rays shading by the control gate as a switch of redundant selection, the information on the storage element of the switch of redundant selection is held, without eliminating them, since ultraviolet rays do not carry out incidence. Therefore, a desired redundant change can be performed. Moreover, a redundant change can be performed without requiring a complicated process like [at the time of using the conventional laser fusing fuse for the switch of redundant selection], since it can program and change and information can be given by using a semiconductor storage element for the switch of redundant selection.

[0018] [Embodiments of the Invention] this invention is a semiconductor storage element which has a source field, a drain field, the floating gate, and the control gate, is covered at the control gate where the floating gate consists of material which does not penetrate ultraviolet rays, and changes.

[0019] Moreover, this invention is the manufacture method of a semiconductor storage element of having the process which forms the process which forms the 1st electrode layer through a gate insulator layer on a semiconductor substrate, carries out pattern processing of the 1st electrode layer, and forms the floating gate, and the 2nd electrode layer which consists of material which does not penetrate ultraviolet rays through the insulating layer between the gates so that the floating gate may be covered, carries out pattern processing of the 2nd electrode layer, and forms the wrap control gate for the floating gate.

[0020] Moreover, this invention is a semiconductor memory using the semiconductor storage element covered at the control gate which consists of material into which the floating gate does not penetrate ultraviolet rays as a switch of redundant selection.

[0021] Hereafter, with reference to a drawing, the example of the semiconductor storage element of this invention, its manufacture method, and a semiconductor memory is explained. Drawing 1 and drawing 2 show the outline block diagram of the field which is equivalent to one memory cell of a nonvolatile semiconductor storage element with a semiconductor storage element and this example. A cross section [in / A-A' of drawing 1 / drawing 1 / in plan and drawing 2 A] and drawing 2 B show the cross section in B-B' of drawing 1 .

[0022] This semiconductor storage element minds the tunnel-gate insulator layer 2 for example, on the semiconductor substrate 1 which consists of silicon. For example, the floating gate 3 which consists of a polycrystal silicon layer which doped Lynn as an impurity is formed. This floating gate 3 is covered, for example, they are SiO2 / SiN/SiO2. The insulating layer 4 between the gates which consists of a cascade screen is formed. On this, the control gate 5 which consists of a cascade screen of Silicide WSi and polycrystal silicon is formed, and the memory cell 10 is constituted.

[0023] As shown in drawing 2 A, source field 6S and drain field 6D by the diffusion layer is formed in the position of the both sides which face across the control gate 5 in the semiconductor substrate 1. a part of isolation layer 7 to which the floating gate 3 performs isolation of the circumference on the tunnel-gate insulator layer 2 on the other hand as shown in drawing 2 B -- it is formed ranging over the top The isolation layer 7 separates the active field 8 of a memory cell 10 shown in drawing 1 from a surrounding memory cell. In this active field 8, the above-mentioned thin tunnel-gate insulator layer 2 is formed on the semiconductor substrate 1. 9 is the contact section of source field 6S and drain field 6D and the upper wiring.

[0024] Especially in this example, the control gate 5 is formed by the material which does not penetrate ultraviolet rays, for example, the so-called metal polycide by which the WSi layer was formed on the polysilicon contest layer. By the control gate 5 which consists of material which does not penetrate these ultraviolet rays, as shown in drawing 2 A and drawing 2 B, ultraviolet rays can be efficiently intercepted by wearing the upper surface and the side of the floating gate 3. Moreover, since the control gate 5 is covered also with the side of the floating gate 3, it can also prevent the incidence of the ultraviolet rays from the side which poses a problem in the example of above-mentioned drawing 5 .

[0025] Since the control gate 5 which consists of material which does not penetrate ultraviolet rays is covered with the floating gate 3 according to the semiconductor storage element of an above-mentioned this example, the incidence of the ultraviolet rays from the upper part of the floating gate 3 and the side can be prevented, and change of the content of storage of the semiconductor storage element by ultraviolet-rays incidence can be prevented.

[0026] Moreover, in order to end even if it does not form a shading film widely since it can shade by the control gate 5 which did not newly prepare a shading film separately on the storage element, and covered the floating gate 3, the restrictions on a design are reduced. Therefore, the miniaturization of a semiconductor storage element can be attained and it can shade.

[0027] As the method of this nonvolatile semiconductor storage element of operation, it carries out as follows, for example. the control gate 5 -- negative voltage, source field 6S, and the well formed in the semiconductor substrate 1 although not illustrated -- by impressing right voltage to a field, an electron can be drawn out from the floating gate 3 and a storage element can be made into switch-on on the other hand -- the control gate 5 -- right voltage, and source field 6S and a well -- by impressing negative voltage to a field, an electron is poured into the floating gate 3 and a storage element can be made into non-switch-on

[0028] And if a semiconductor memory is constituted using a further above-mentioned semiconductor storage element as a redundant selecting switch, even if the ultraviolet rays for eliminating the information on the semiconductor storage element of a main part will carry out incidence, since the control gate which consists of material which does not penetrate ultraviolet rays is covered with the floating gate and it is held [redundant

information is not rewritten and], the semiconductor storage element of a redundant selecting switch can realize an efficient redundancy system. Moreover, a redundant change can be performed without requiring a complicated process like [at the time of using the conventional laser fusing fuse for the switch of redundant selection], since it can program and change and information can be given by using a semiconductor storage element for the switch of redundant selection.

[0029] Next, the manufacture method of this nonvolatile semiconductor storage element is explained using a drawing. First, as shown in drawing 3 A, the tunnel-gate insulator layer 2 is formed on the semiconductor substrate 1 which consists of silicon. Furthermore, the 1st electrode layer 11 which consists of polycrystal silicon used as the floating gate 3 which doped Lynn, for example as an impurity is deposited on behind. Next, as shown in drawing 3 B, pattern processing of this 1st electrode layer 11 is carried out, and the floating gate 3 is formed.

[0030] Then, they are SiO2 / SiN/SiO2 extensively [as shown in drawing 3 C / cover a floating-gate 3 top and]. The insulating layer 4 between the gates which consists of a cascade screen is formed. Furthermore, the 2nd electrode layer 12 which consists of a cascade screen of Silicide WSi and polycrystal silicon as a material which does not penetrate ultraviolet rays is formed on the insulating layer 4 between the gates.

[0031] Next, as shown in drawing 3 D, pattern processing is performed in the 2nd electrode layer 12 of the gate section simultaneously with processing of the gate section of a surrounding transistor, and the control gate 5 is formed. Furthermore, source field 6S and drain field 6D is formed in the semiconductor substrate 1. Thus, the semiconductor storage element which consists of a memory cell 10 of the structure shown in drawing 1 is obtained.

[0032] According to the manufacture method of the nonvolatile semiconductor storage element of an above-mentioned this example, the control gate 5 which consists of material which does not penetrate ultraviolet rays can manufacture the semiconductor storage element which can shade ultraviolet rays by covering the floating gate 3 through the insulating layer 4 between the gates, and being formed. Moreover, in order to form the control gate 5 and to consider as a shading film, manufacture is possible with the manufacturing process of the usual semiconductor storage element, and even if it does not make a manufacturing process increase, the semiconductor storage element which can shade ultraviolet rays can be manufactured.

[0033] By the way, what has the so-called stack gate structure which carried out laminating formation of the control gate and the two-layer gate of the floating gate by the same pattern through the insulating layer between the gates like the example previously shown in drawing 5 as structure of the present memory is used. In the case of this structure, it is common to perform separately processing of the gate sections, such as a surrounding transistor, and processing of the stack gate of each memory cell of a memory array, respectively.

[0034] On the other hand, simultaneously with processing of the gate section of a circumference transistor, by the manufacture method of the semiconductor storage element of an above-mentioned example, the gate section of the nonvolatile semiconductor storage element with which ultraviolet-rays shading is made is processed.

[0035] On the other hand, simultaneously as other examples of the manufacture method of the semiconductor storage element of this invention with processing of the stack gate of each memory cell of the semiconductor storage element of main parts other than a redundant selecting switch with which a memory array, i.e., ultraviolet-rays shading, is not carried out, you may process the gate section of the nonvolatile semiconductor storage element with which ultraviolet-rays shading is made. In this case, although the semiconductor substrate 1 can be dug and crevice 1a is formed after processing of the stack gate of each memory cell of a memory array as 1 process drawing of a manufacturing process is shown in drawing 4 , even if it forms source field 6S and drain field 6D in this crevice 1a, the property top of a semiconductor storage element does not become a big problem.

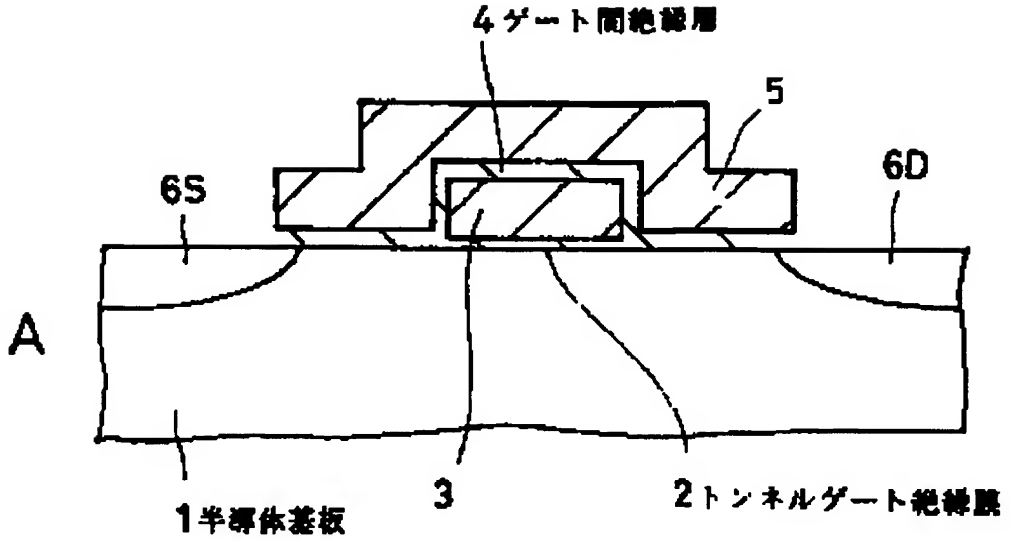
[0036] The semiconductor storage element of this invention, its manufacture method, and a semiconductor memory are not limited to an above-mentioned example, and, in addition to this, various composition can take them in the range which does not deviate from the summary of this invention.

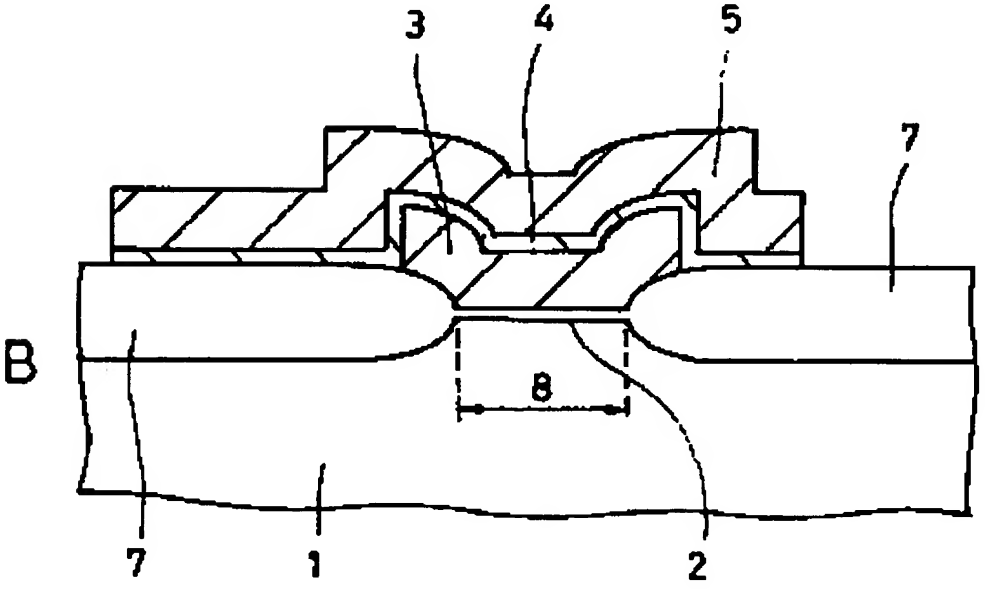
[0037] [Effect of the Invention] Since the floating gate is covered at the control gate which consists of material which does not penetrate ultraviolet rays according to the semiconductor storage element of this invention, the incidence of ultraviolet rays can be prevented and change of the information by ultraviolet-rays incidence can be prevented. Moreover, since it shades by the control gate which covered the floating gate, without newly preparing a shading film, the incidence of the ultraviolet rays from the side of the floating gate can be prevented, and since it ends even if it does not form a shading film widely while being able to constitute the semiconductor storage element with which change of the information by ultraviolet rays does not take place, the further miniaturization of a semiconductor storage element can be attained.

[0038] According to the manufacture method of the semiconductor storage element of this invention, the control gate which consists of material which does not penetrate ultraviolet rays can manufacture the semiconductor storage element which can shade ultraviolet rays by covering the floating gate through the insulating layer between the gates, and being formed. Moreover, in order to form the control gate and to consider as a shading film, manufacture is possible with the manufacturing process of the usual semiconductor storage element, and even if it does not make a manufacturing process increase, the semiconductor storage element which can shade ultraviolet rays can be manufactured.

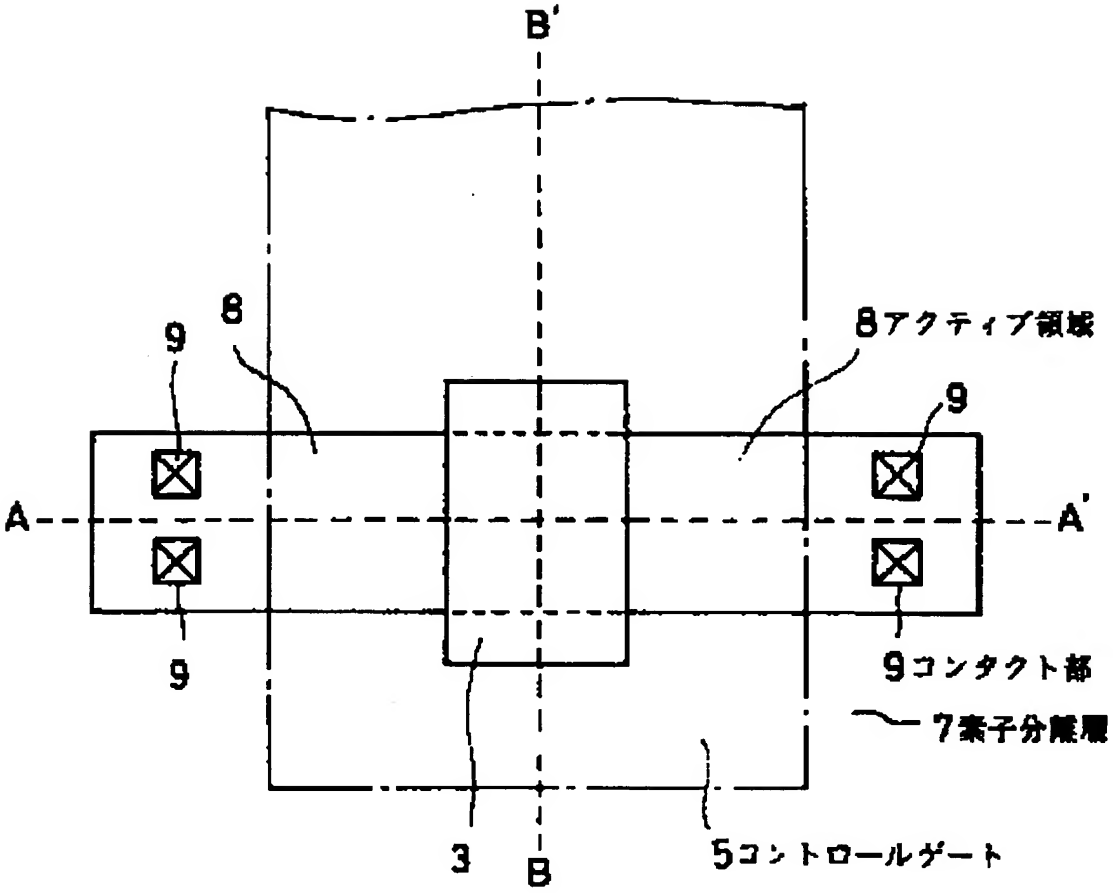
[0039] According to the semiconductor memory of this invention, even if it performs ultraviolet-rays elimination to storage elements other than this switch by using the semiconductor storage element which can carry out ultraviolet-rays shading by the

control gate as a switch of redundant selection, the information on the storage element of the switch of redundant selection is held, without eliminating them, since ultraviolet rays do not carry out incidence. Therefore, a desired redundant change can be performed. Moreover, a redundant change can be performed without requiring a complicated process like before, since it can program and change and information can be given by using a semiconductor storage element for the switch of redundant selection.





実施例の断面図



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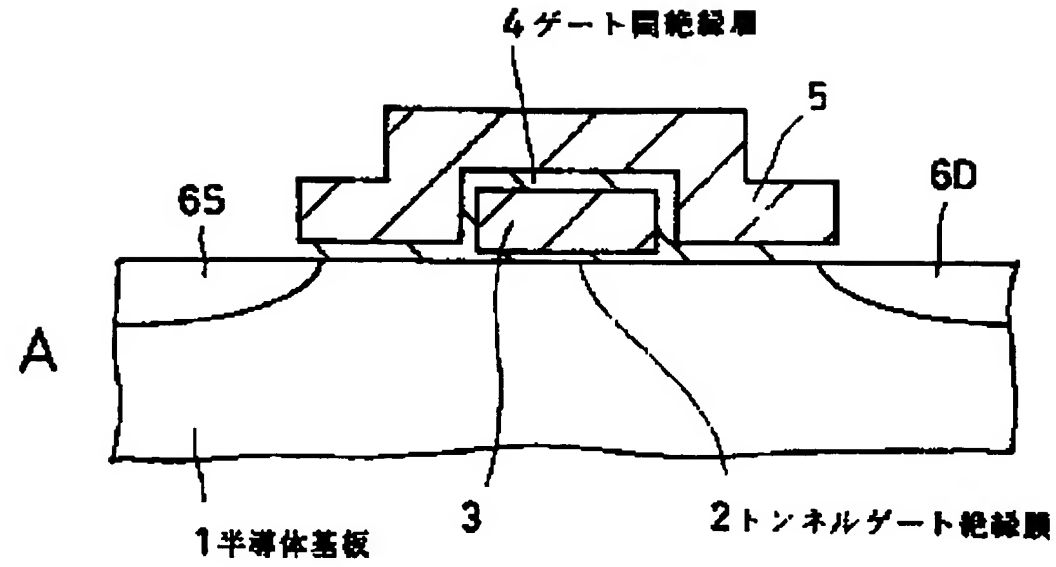

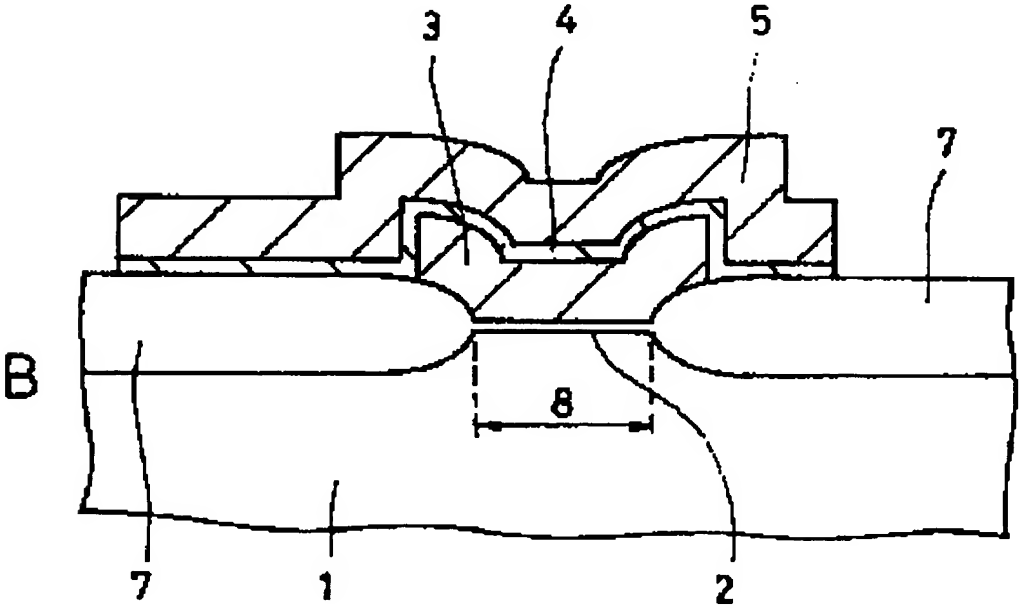

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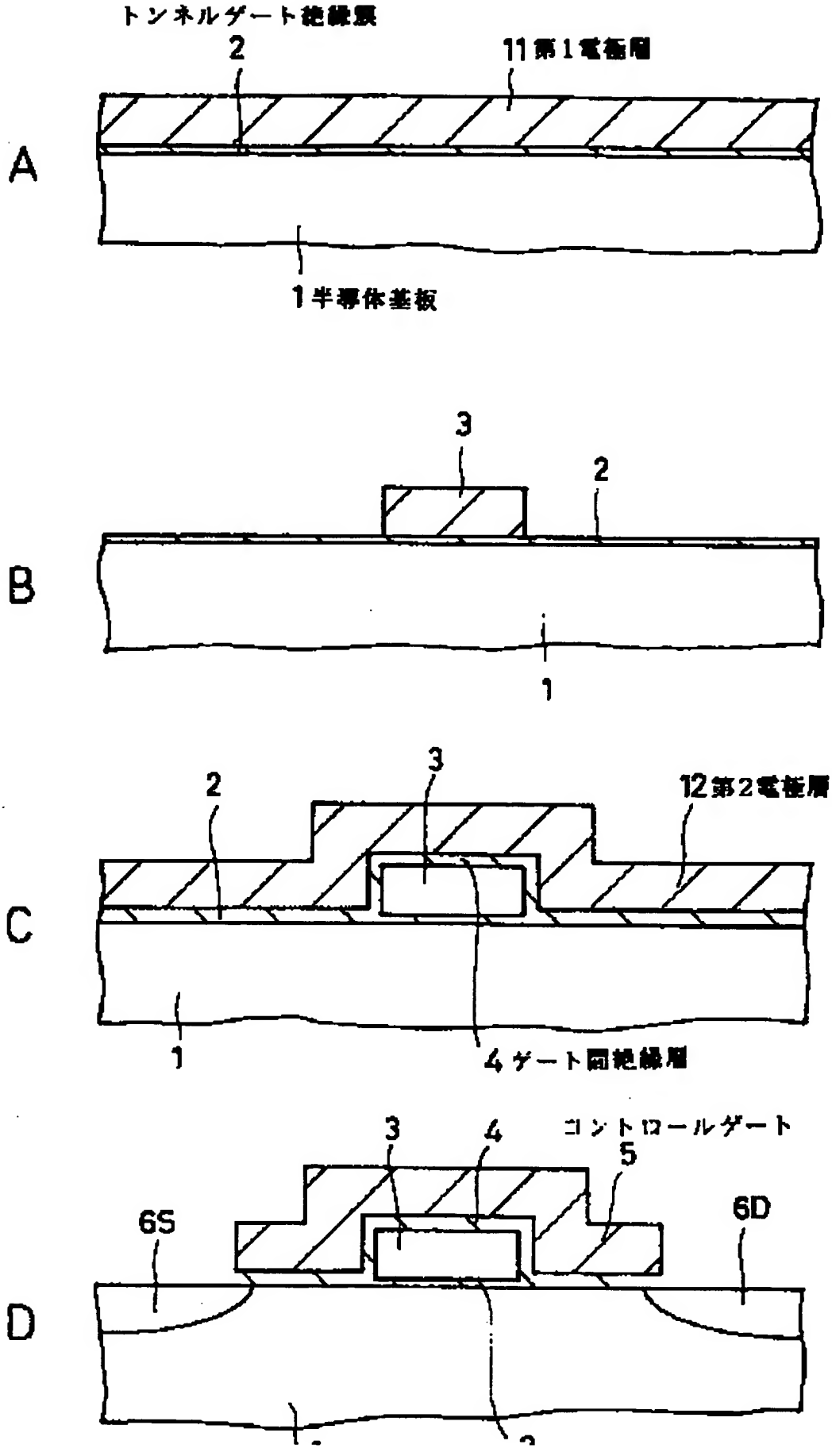
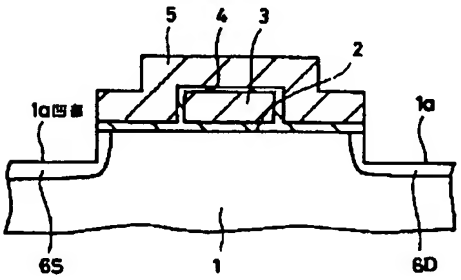
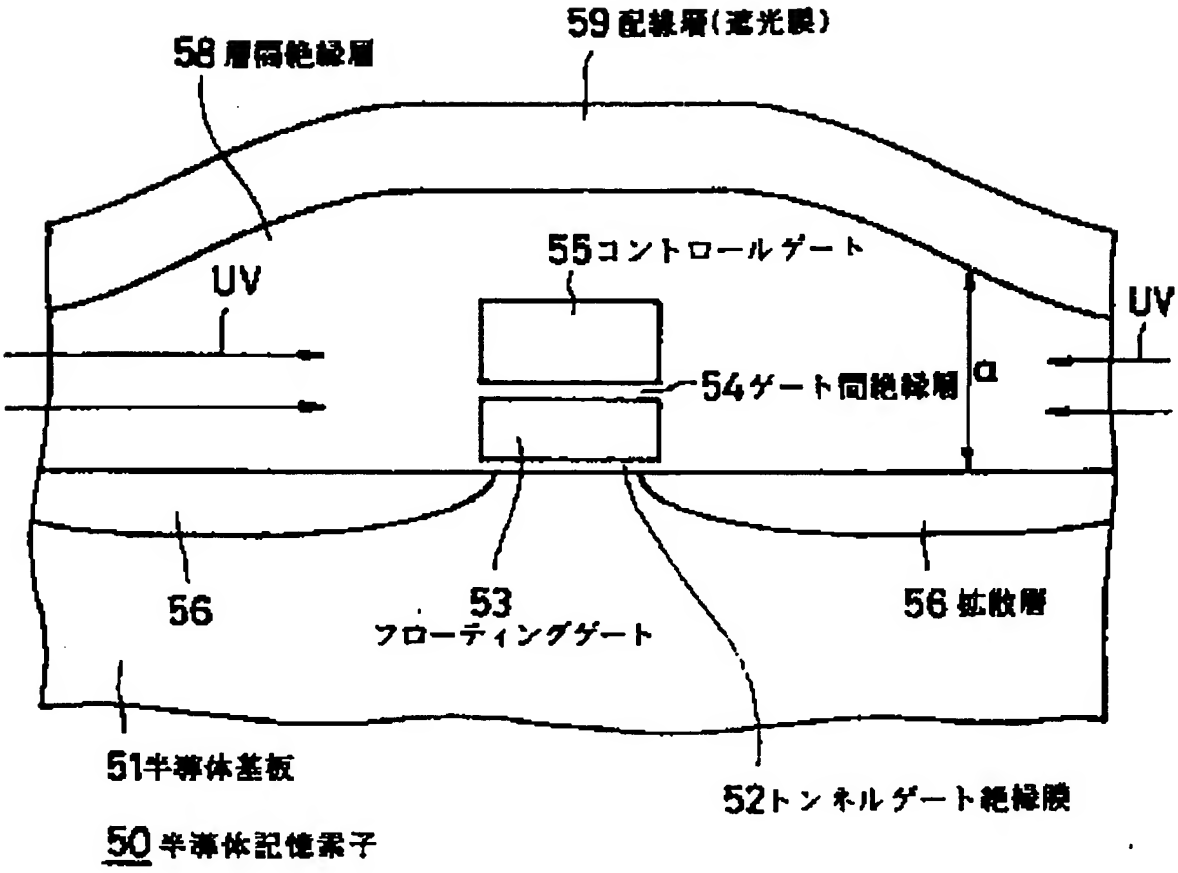

トンネルゲート絶縁膜
2
11第1電極層
A
1半導体基板
3
2
B
1
3
2
12第2電極層
C
1
4ゲート絶縁膜
3
4
コントロールゲート
5
6S
6D
D

Drawing selection drawing 4



他の実施例の製造工程図

[Translation done.]


59 配線層(遮光膜)
58 層間絶縁層
55コントロールゲート
UV
UV
54ゲート間絶縁層
a
56
53
フローティングゲート
56 拡散層
51半導体基板
52トンネルゲート絶縁膜
50 半導体記憶素子

従来例の構成図